WEATHER, FORECASTS, AND WARNINGS FOR THE MONTH.

By Prof. E. B. GARRICTT, in charge of Forecast Division.

Over a great portion of the United States the month was the warmest and driest March shown by Weather Bureau records. During the first decade of the month mean temperatures ranged from 5° to 15° above the normal. During the second decade temperatures continued high from the Great Lakes and central valleys to the Pacific coast and in the upper Missouri Valley, the means were 15° to 23° above the normal. Excessively high temperatures continued during the balance of the month over central and northern districts where the departures above the normal for that period were 15° to 25°, and from the 21st to 29th the highest day temperatures on record for March were reported from the Missouri Valley, over the upper Mississippi Valley, Lake region, Ohio Valley, and New England. Over the Plateau and Rocky Mountain districts cooler weather prevailed at intervals during the latter portion of the month, and by the close of the month the cooler weather had extended over interior portions of the country. For the month, as a whole, the mean temperature was above the normal, except over the southern extremity of the Florida Peninsula and over the Missouri and upper Mississippi valleys, the means were 15° to 20° above the normal.

The most marked deficiency in precipitation occurred from the lower Ohio Valley, over the middle Gulf, and interior of the South Atlantis States, where the rainfall for the month was 4 inches or more less than the March average. From the Mississippi Valley to the Atlantic coast and on the north Pacific coast the deficiency was generally 2 or more inches. Excesses in precipitation occurred only at points in southeastern Florida, adjoining portions of the western Dakotas, and eastern Montana and eastern Wyoming, extreme western Montana and northern Idaho, and on the middle California coast and the interior of Arizona, where the departures were small. The month opened with rain in the east Gulf States and along the Atlantic and north Pacific coasts, and on the 7th and 8th rain and snow fell from the Lake region over New England. From the 9th to 20th fair weather was general, except from central Texas over the Gulf and Atlantic coast States where showers occurred from the 9th to 13th. During the third decade of the month rain fell on the Pacific coast on the 22d and 23d and from the 27th to the close of the month rains that set in on the Pacific coast overspread the Rocky Mountain districts, central valleys, and a great portion of Texas. Over a greater portion of the interior of the country the precipitation for the month was less than 1 inch and the total amount was less than 2 inches, except over a portion of Florida, locally in Texas and Arizona, and along the Gulf, Atlantic, and Pacific coasts. Snowfalls were light, except in the mountain districts of Colorado, southeastern Wyoming, northern New Mexico, and northern Arizona.

Floods, originating from melting snow supplemented by warm rains during the closing week of February, occurred during the opening days of March in the Ohio Valley, lower Lake region, Pennsylvania, and New York. The accumulation of snow in those districts had been heavy, ground surfaces were frozen or saturated by previous rains or melting snow, and a rapid run-off of water and a consequent rapid rise of streams resulted. Information regarding the scope of the floods will be found under the heading Rivers and Floods.

The following special forecast was issued March 6, 1910:

During the present week a marked change from the abnormally warm and stagnated conditions that prevailed during the past week will be experienced. A change to colder weather that appeared over the northwest to-day (Sunday) will overspread the central valleys and Lake region Monday and reach the Atlantic seaboard Monday night and Tuesday. A disturbance from the Pacific will cross the country during the latter half of the week. Another disturbance that promises to produce widespread and general rains will advance from the Pacific to the Atlantic coasts over a more southern course, and reach the Atlantic States about the middle of the month.

The change to colder weather occurred as indicated and the temperature of the week averaged near the normal over the country generally. Thursday morning a disturbance from the north Pacific was central north of Montana and another disturbance that had advanced from the south Pacific coast had assumed form over Texas. Rain had set in over the lower Ohio, lower Mississippi, and lower Missouri valleys and thunderstorms were reported in the Gulf States, Arkansas, and Tennessee. During Thursday the area of precipitation extended to the middle and south Atlantic coasts and in the Middle Atlantic States, the precipitation was in the form of snow. By Friday morning the northwestern disturbance had advanced to Wisconsin and the southwestern disturbance had reached Georgia, snow had fallen over Wisconsin, Minnesota, and Upper Michigan and frost had formed as far south as northern Texas and northwestern Louisiana.

During Saturday and Sunday the southern storm moved norteastward off the middle Atlantic coast and by Monday morning was joined by a disturbance of marked intensity that had advanced during the preceding 2 days from the British Northwest over the Lake region. The disturbances were attended by rain in Southern and Middle-Eastern States, by snow flurries from the Lake region, over the upper Ohio Valley, and North Atlantic States, and by high winds along the middle Atlantic and New England coasts.

On Sunday, March 13, the following special forecast was issued:

Compared with the past week the present week will be comparatively warm generally over the United States. A period of cooler weather will however set in over the extreme west about the middle of the week and advance thence to the Atlantic coast by the beginning of next week.

A disturbance will advance from the Pacific and reach the Rocky Mountain districts about the middle of the week, develop strength over the Plains States and central valleys during Friday and Saturday, respectively, and reach the Atlantic seaboard Saturday night or Sunday. The advance of this disturbance will be preceded by temperature rising above the average for the season, attended by precipitation that in the northern tier of States may be in the form of snow, and followed by a sharp fall in temperature.

Temperature continued high during the week over the western half of the United States. In eastern districts the week opened with low temperature, and frost, for which timely warnings were issued, occurred in the Gulf and South Atlantic States and northern Florida. During the middle and closing days of the week temperature rose above the normal generally over the eastern half of the country. Barometric areas were of slight intensity and a disturbance that advanced from the Rockies to the Atlantic coast during the latter half of the week was attended by rains in areas in the central valleys and the Southwest and on Saturday and Sunday by showers in the Lake region, Ohio Valley, Tennessee, and the Middle Atlantic and New England States. The disturbance was followed by a sharp fall in temperature from the middle and upper Mississippi Valley over the Ohio Valley, Lake region, and the Northeastern States.

The following special bulletin was issued March 20:

Spring, that according to the calendar begins March 21, will open with temperature above the average for the season generally throughout the United States.

The present week promises to average warmer than usual, except from the southern Rockies over the southern Plateau and the southern half of California, where temperatures will be somewhat below normal, and from the upper Mississippi Valley over the Great Lakes, New York, and New England, where the beginning and close of the week will show temperatures near or below the average for the season.

On the north Pacific coast and thence over the northern Plateau and northern Rocky Mountain districts rains will be unusually frequent and in the northwestern mountain districts the precipitation will be partly in the form of snow.

The week will open with fair weather from the Rocky Mountains to the Atlantic coast, except in the Northeastern States, where showers will precede

clearing weather. A barometric disturbance that will advance over the Rockies and the Plains States Monday and Tuesday, and cross the central valleys and Lake region Wednesday and Thursday, will reach the Atlantic States Thursday night or Friday attended by precipitation that will be largely in the form of showers.

The week following the vernal equinox averaged unusually warm in the United States, with temperatures 20° to 30° above the normal about the middle of the week from the Rockies over the central valleys and Lake region. The week opened with temperature somewhat below the average for the season in the East and closed with temperature near the normal over the greater portion of the country. A barometric disturbance crossed the country as scheduled, but was practically unattended by rain east of the Rockies. On the Pacific coast precipitation occurred on several days and in northern Rocky Mountain districts the precipitation was partly in the form of snow. Over western Europe and adjacent waters the weather of the week was fine and along and south of the transatlantic steamer routes light to moderate winds and smooth seas prevailed. Over middle and southern latitudes of the Pacific and adjacent Asiatic coasts no severe storms were reported. In eastern Europe and the interior Siberian area marked barometric changes produced unsettled and stormy weather.

About the middle of the month the so-called permanent winter high area over Siberia began to show signs of distintegration, and pressures increased over the Atlantic and Pacific areas. This period of transition from winter to spring distribution of atmospheric pressure continued until March 25, when winter pressure was again resumed over the Siberian area and pressure began to decrease over western Europe and the Atlantic. Based on a consideration of barometric conditions over the Northern Hemisphere the following bulletin was issued March 27:

During the present week temperature in the United States will average mild for the season. A disturbance that now occupies the California coast will move eastward and reach the Atlantic coast about Friday. Another disturbance is indicated that will cross the country from about March 31 April 1. The disturbances should be attended by rains of increasing area and will be followed by changes to colder weather. Atmospheric movements will be more active along the transatlantic steamer routes, and a period of rains is indicated for the British Isles and northwestern Europe.

The disturbance that occupied California March 27 advanced over the Rocky Mountains and Plains States Tuesday with increasing intensity attended by rain and snow in the Rockies and Plateau regions and by showers and thunderstorms over the Great Plains. By Wednesday morning the center of disturbance had reached the upper Mississippi Valley and general rains had fallen in the Mississippi and Missouri Valleys and the Southwest and snow in the Rocky Mountains and the Northwest. Following the passage of the low area freezing temperature was experienced in the northern Plains States and the Rocky Mountain and Plateau districts. By Thursday morning the low area had advanced over eastern Ontario with diminished strength, scattered rains had occurred from the Lake region, over the Mississippi Valley, and the Southwest and in Texas the rainfalls were rather heavy. The cooler weather had extended over the central valleys and Lake region and the line of freezing temperature had extended southward to the Texas Panhandle. During the next 24 hours light rains occurred from the Ohio Valley and Lake region eastward and showers continued in Texas. Pressure decreased on the Pacific coast during the 31st and the morning of April 1 depressions covered the northern portion of the State of Washington, southern California, and adjacent portions of southern Nevada.

Average temperatures and departures from the normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	12	38.8	+ 6.0	+ 9.8	+ 3.3
Middle Atlantic	15	47.8	+ 8.0	+ 8.9	+ 3.0
South Atlantic	10	59.2	+ 5.4	+ 4.2	+ 1.4
Florida Peninsula*	8	66.4	+ 0.1	0.0	0.0
East Gulf	11	63.3	+ 6 0	+ 4.4	+ 1.5
West Gulf	10	64.4	+ 7.1	+ 6.6	+ 2.2
Ohio Valley and Tennessee	13	54.6	+10 0	+ 7.6	+ 2.5
Lower Lakes	10	42.0	+ 9.7	+ 8.7	+ 2.9
Upper Lakes	12	39.8	+12.6	+12.5	+ 4.2
North Dakota*	9	40.3	+19.5	+19.4	+ 6.5
Upper Mississippi Valley	14	50.3	+14.3	+12.3	+ 4.1
Missouri Valley	12	53.3	+17.2	+17.2	+ 5.7
Northern slope	9	44.9	+14.1	+11.7	+ 3.9
Middle slope	6	55.3	+12.8	+14.3	+ 4.8
Southern slope*	8	60.2	+ 7.8	+ 8.5	+ 2.8
Southern Plateau*	10	56.1	+ 4.9	+ 4.9	+ 1.6
Middle Plateau*	11	46.0	+ 7.6	+ 0.9	+ 0.3
Northern Plateau*	9	46.2	+ 7.9	+ 2.5	+ 0.8
North Pacific	7	47.5	+ 3.3	+ 0.7	+ 0.2
Middle Pacific	5	55.0	+ 2.4	− 2.3	− 0.8
South Pacific	4	58.1	+ 3.0	+ 2.0	+ 0.7

Average precipitation and departures from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		Inches.	Inches.
New England	11	1.45	38	− 2.4	− 0.4
Middle Atlantic	15	0.98	27	− 2.7	− 2.4
South Atlantic	11	1.26	29	− 3.1	− 4.8
Florida Peninsula*	8	2.22	76	− 0.7	− 2.6
East Gulf	11	1.47	25	− 4.4	− 5.6
West Gulf	10	1.56	49	− 1.6	− 3.3
Ohio Valley and Tennessee	13	0.47	11	− 4.0	− 1.5
Lower Lakes	10	0.60	23	− 2.0	+ 0.2
Upper Lakes	12	0.28	13	− 1.9	− 2.5
North Dakota*	9	0.96	91	− 0.1	− 0.6
Upper Mississippi Valley	15	0.30	12	− 2.1	− 2.6
Missouri Valley	12	0.48	26	− 1.4	− 1.4
Northern slope	9	0.93	82	− 0.2	− 0.1
Middle slope	6	0.28	19	− 1.2	− 1.7
Southern slope*	8	0.62	51	− 0.6	− 2.1
Southern Plateau*	10	0.60	86	− 0.1	− 1.2
Middle Plateau*	11	0.50	38	− 0.8	− 2.2
Northern Plateau*	9	0.86	59	− 0.6	− 1.0
North Pacific	7	2.82	57	− 2.1	− 1.3
Middle Pacific	7	3.12	84	− 0.6	− 3.0
South Pacific	4	2.01	77	− 0.6	− 3.5

*Regular Weather Bureau and selected cooperative stations.

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex.	26	54	s.	Mount Weather, Va.	15	54	nw.
Do	28	50	s.	North Head, Wash.	1	56	s.
Bismarck, N. Dak.	6	58	nw.	Do.	5	50	w.
Do.	23	60	w.	Oklahoma, Okla.	6	52	n.
Burlington, Vt.	19	50	sw.	Do.	28	50	s.
Do.	28	66	s.	Pierre, S. Dak.	27	60	w.
Do.	31	50	s.	Do.	29	55	nw.
Cheyenne, Wyo.	1	56	w.	Point Reyes Light, Cal.	4	54	nw.
Chicago, Ill.	6	50	w.	Do.	5	54	nw.
Denver, Colo.	29	50	n.	Do.	7	58	nw.
Detroit, Mich	6	50	w.	Do.	8	52	nw.
Devils Lake, N. Dak.	6	60	nw.	Do.	22	58	nw.
Duluth, Minn.	21	56	sw.	Do.	23	61	nw.
Do.	24	50	sw.	Do.	26	64	s.
Do.	27	54	sw.	Do.	27	50	nw.
El Paso, Tex.	28	57	w.	Do.	28	50	nw.
Havre, Mont.	5	60	w.	Rapid City, S. Dak.	23	66	sw.
Minneapolis, Minn.	6	54	nw.	St. Paul, Minn.	6	52	w.
Mount Tamalpais, Cal.	5	61	nw	Sheridan, Wyo.	23	50	nw.
Do.	7	52	nw.	Sioux City, Iowa	6	52	nw.
Do.	21	50	se.	Southeast Farallon, Cal.	26	56	s.
Do.	22	68	nw.	Tatoosh Island, Wash.	1	51	s.
Do.	23	52	nw.	Do.	4	52	sw.
Mount Weather, Va.	7	60	nw.	Do.	5	50	sw.
Do.	14	57	nw.	Williston, N. Dak.	5	58	w.

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	72	− 3	Missouri Valley	57	−15
Middle Atlantic	69	− 3	Northern slope	57	−10
South Atlantic	73	− 2	Middle slope	47	−13
Florida Peninsula	78	+ 1	Southern slope	48	− 7
East Gulf	64	− 9	Southern Plateau	43	+ 7
West Gulf	66	− 6	Middle Plateau	52	− 4
Ohio Valley and Tennessee	61	−10	Northern Plateau	61	− 5
Lower Lakes	68	− 8	North Pacific	82	+ 7
Upper Lakes	71	− 8	Middle Pacific	77	+ 3
North Dakota	73	− 5	South Pacific	73	+ 2
Upper Mississippi Valley	63	−10			

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.1	− 0.6	Missouri Valley	2.8	− 2.9
Middle Atlantic	4.1	− 1.6	Northern slope	3.9	− 1.5
South Atlantic	3 4	− 1.5	Middle slope	2.8	− 1.8
Florida Peninsula	2.9	− 0.9	Southern slope	3 8	− 0.6
East Gulf	3.0	− 2.0	Southern Plateau	2.7	− 1.0
West Gulf	3.4	− 1.7	Middle Plateau	4.1	− 0.9
Ohio Valley and Tennessee	4.2	− 1.8	Northern Plateau	5.2	− 0.6
Lower Lakes	4.4	− 2.2	North Pacific	6 2	− 0.4
Upper Lakes	4.7	− 1.3	Middle Pacific	5.6	− 0.2
North Dakota	4.2	− 1.6	South Pacific	5.0	− 0.8
Upper Mississippi Valley	3.1	− 2.6			

RIVERS AND FLOODS.

By Prof. H. C. FRANKENFIELD, in charge River and Flood Division.

At the end of February, 1910, a snow flood was in progress in the Allegheny River, and on the 1st day of March flood stages were general over the lower portion of the river and its tributaries, Pittsburg reporting the flood stage of 22 feet at 4 p. m., while at Freeport, Pa., the crest stage was 24.6 feet, 4.6 feet above the flood stage at 1 a. m. A second rise of similar character came down from the headwaters a few days later, but as it was not supported by the tributaries, flood stages were not reached below the mouth of the Kiskiminetas River. The flood wave continued down the Ohio River, absorbing on its way considerable additions from all the northern tributaries from the Beaver to the Wabash.

The following table shows the flood stages at the various stations, the crest stages and the dates and times of their occurrence:

Station.	Flood stage.	Crest stage.	Date.	Time.
	Feet.	*Feet.*		
Pittsburg, Pa	22	22.0	1	4 p. m.
Davis Island Dam, Pa	25	21.4	1	9 p. m.
Dam No. 2, Pa	25	22.8	1	9 p. m.
Beaver Dam, Pa	27	34.4	2	3 a. m.
Wheeling, W. Va	36	37.4	3	12 noon.
St. Marys, W. Va	38	38.0	4	8 a. m.
Marietta, Ohio	36	41.2	4	12 noon.
Parkersburg, W. Va	36	42.0	4	5 p. m.
Point Pleasant, W. Va	39	45.0	5	3 p. m.
Huntington, W. Va	50	47.7	6	12 noon.
Catlettsburg, Ky	50	48.9	6	
Portsmouth, Ohio	50	50.9	6	8 a. m.
Maysville, Ky	50	49.3	6	8 a. m.
Cincinnati, Ohio	50	51.8	7	8 a. m.
Madison, Ind	46	41.8	7.8	
Louisville, Ky	28	24.3	8	4 p. m.
Evansville, Ind	35	39.7	10	8 a. m.
Henderson, Ky	35	38.0	10	5 p. m.
Mount Vernon, Ind	35	39.8	11	5:30 p.m.
Shawneetown, Ill		42.0	12	
Paducah, Ky	43	36.2	11–13	
Cairo, Ill	45	42.2	15	

It will be noticed that the differences between the flood crests at Pittsburg and places below were much greater than ususal This was due in largest measure to the great volumes of water from the northern tributaries, those to the southward contributing but little, although the secondary rise from the Allegheny River, and the retardation caused by the elevation of the water plane over the lower 200 miles of the river were of material assistance.

The warnings issued for these floods were of the usual accurate and timely character, and were instrumental in saving a large amount of property. As far as could be learned the losses were about as follows:

District.	Property.	Crops.	Lands.	Suspension of business.	Saved by warnings.
Pittsburg, Pa	$5,000			$20,000	$100,000
Parkersburg, W. Va.*					
Cincinnati, Ohio*					
Louisville, Ky.*					
Evansville. Ind.*					
Cairo, Ill	5,000	$2,000	$1,000	3,000	50,000
Total	10,000	2,000	1,000	23,000	150 000

* Nothing of consequence.

The steamer *Virginia* lost her course during the night of March 5–6, and was stranded in a cornfield near Willow Grove, W. Va. She will probably not be floated unless another stage of 45 feet occurs at Point Pleasant, W. Va., during the present season.

Along the interior rivers of the State of Ohio, conditions were very much complicated by ice gorges, and definite forecasts of flood stages were impossible. General warnings were issued frequently, however, and all having property interests were able to take measures to make them secure. Flood stages were reached in all the rivers, and the losses were estimated at about $1,000,000.

At Defiance, a gorge in the Auglaize River carried away the Francis street highway bridge, causing a loss of $50,000, and at Napoleon, Ohio, on the Maumee River, the damage amounted to between $30,000 and $40,000.

The Wabash River flood was not so serious, although at Mount Carmel, Ill., the river was above the flood stage of 15 feet from March 1 to 13, inclusive, with a crest stage of 21.9 feet on March 9. The losses amounted to about $6,000, principally of crops.

Nothing of consequence occurred in the Missouri River above Williston, N. Dak. Between Williston and Bismarck, N. Dak., numerous ice gorges had formed, and conditions became so threatening in the vicinity of Bismarck that flood warnings were issued on March 13. At Bismarck the river rose above the flood stage of 14 feet on March 13, reached a crest of 26.4 feet at 2:20 p. m., March 14, and fell below flood stage at 3 p. m., March 16.

Losses were as follows:

Property, exclusive of crops	$100,000
Crops	5,000
Lands	none.
Total	105,000

Property to the amount of at least $100,000 was saved through the Weather Bureau warnings. The crest of the rise reached Pierre, S. Dak., at 6 p. m., March 18, with a stage of 15 feet, 1 foot above flood stage, and did practically no damage. While the floods below Bismarck were of no great consequence, they were of special interest in that they were the first to afford opportunity for observation and investigation since the organization of the river and flood service in that section. The losses, while considerable in the aggregate, did not fall heavily upon particular communities or individuals, and a large amount of property was saved through the Weather Bureau warnings, the issue of which was greatly hampered by inadequate methods of communication.

The crest stage at Sioux City, Iowa, was reached at 5 p. m., March 20, when the gage read 16.8 feet, 0.2 foot below the flood stage. It has been impossible to obtain any satisfactory estimate of the losses caused by these floods, but judging from the few reports received, the total could not have been less than $50,000, while the value of property saved through the warnings was probably nearly as much.

The James River flood was most pronounced in the vicinity of Huron, S. Dak., where the river remained above the flood